C5.3 Haunches

C5.3.1 General

C5.3.1.1 Policy overview

Methods Memo No. 62: Beam Line Haunch Elevations for PPCB and Steel Girder Bridges
28 August 2002

See C5.3.2.2.

C5.3.1.2 Design information

C5.3.1.3 Definitions

C5.3.1.4 Abbreviations and notation

C5.3.1.5 References

C5.3.2 PPCB bridges

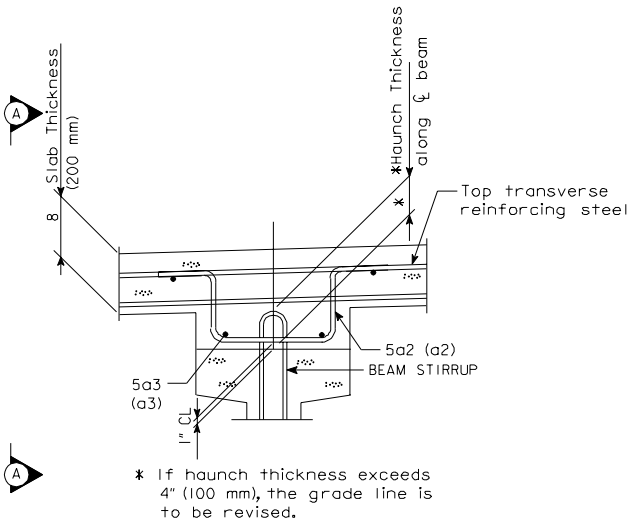
C5.3.2.1 Analysis and design

Methods Memo No. 26: Haunch Reinforcement for PCBM
24 July 2003

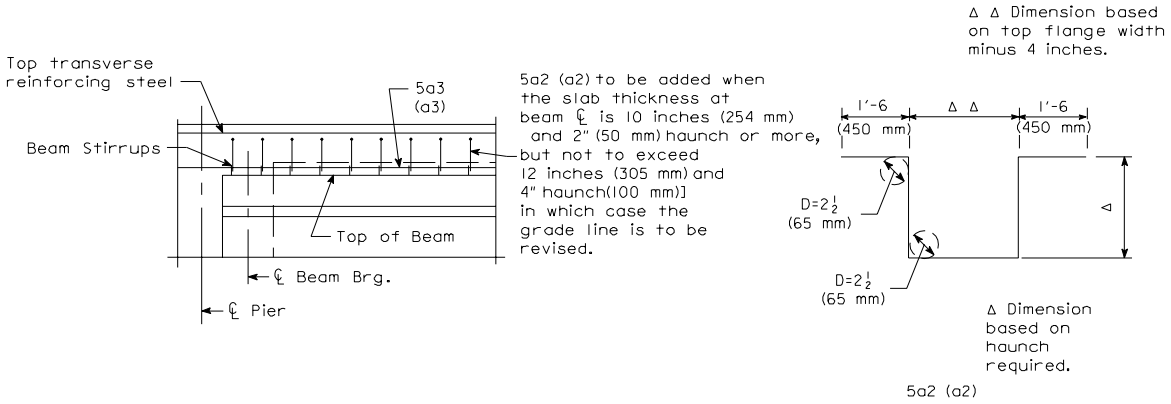
A request was made by the Construction Office to modify the details we use for haunch reinforcement for prestressed beam bridges. The current details in Article 5.3 "PPCB Bridges" of the Design Manual have a total width of the 5a2 (a2) of approximately 15.75 inches (395 mm). When the contractor places the a2 bars, they have had problems maintaining the bars in the proper position because the legs of the haunch reinforcement cannot reach the longitudinal bars in the slab (outside the width of the top flange).

Therefore, to help with the placement of the bars, the a2 details were lengthened to allow the legs of the bar to be tied to the longitudinal bars in the top mat of reinforcing next to the beam. See attached details. Please provide this change on all projects where additional haunch steel is required and have not been turned in for letting.

When detailing prestressed beam bridges where the haunch in the midspan region is over the 2-inch maximum depth because of geometry and beam camber and option 1 or 2 of the design manual article 5.3 is to be used. Use option 1 and reinforce the beam haunch as noted below. Using this detail will allow the contractor more flexibility in the field if the beam camber does not meet the plan dimensions. Continue to use option 2 when the controlling haunch is at the beam ends rather than at the mid-span of the beam.



SECTION AT
℄ PIER BEARING



SECTION A-A

OPTION 1 DETAILS

PPCB Where haunch > 2" (50 mm)

Methods Memo No. 115: Revised Haunch Policies
4 August 2005

With the release of Bridge Design Manual 5.3 Haunches, the following haunch policies have been revised for prestressed concrete beams (PPCB) and continuous welded plate girders (CWPG).

1. Revisions to MM No. 62 (Beam Line Haunch Elevations for PPCB and Steel Girder Bridges)

   The new office policy has set the minimum field clear distance from the top of the shear reinforcement to the top of slab at 2½ inches (65 mm). Because of this new policy, the maximum allowable embedment of shear studs or reinforcement into a standard 8-inch (200 mm) deck has been revised from 5 inches (125 mm) to 5½ inches (140 mm).

The minimum embedment for shear reinforcement has been revised from 2 ½ inches (65 mm) to 2 inches (50 mm) for CWPG per AASHTO specifications. Minimum embedment for the PPCB shall continue to be 2 ½ inches (65 mm).

2. Revisions to MM No. 89 (Shear Stud Lengths and Haunch Requirements for Steel Girders)

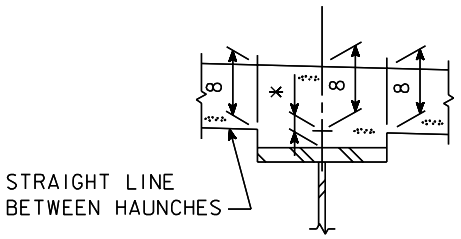
   a. The term "haunch thickening" no longer is used.

   b. The field clearance between top of slab and shear stud has been revised from 3½ inches (90 mm) to 2½ inches (65 mm).

   c. For haunch construction (allowable field haunch), the following changes have been made. Note: This value will not be shown on the plans, but used by the Office of Bridges and Structures as a maximum construction haunch limit that can be used without modifying grade.

   The maximum field haunch for CWPG bridges has been revised from 3 inches (75 mm) to 4 inches (100 mm)

3. The current "Typ. Slab & Haunch Detail" and corresponding note shown on standard cross sections [OBS SS 4305-4310 (M4305-M4310)] has been revised. The new note associated with this detail is shown below.



TYP. SLAB & HAUNCH DETAIL

* CONCRETE HAUNCH DIMENSION MEASURED BETWEEN BOTTOM OF SLAB AND TOP OF TOP FLANGE PLATE AS SHOWN ON THE "THEORETICAL CONCRETE HAUNCH DIAGRAM" SHOWN ELSEWHERE ON THESE PLANS.

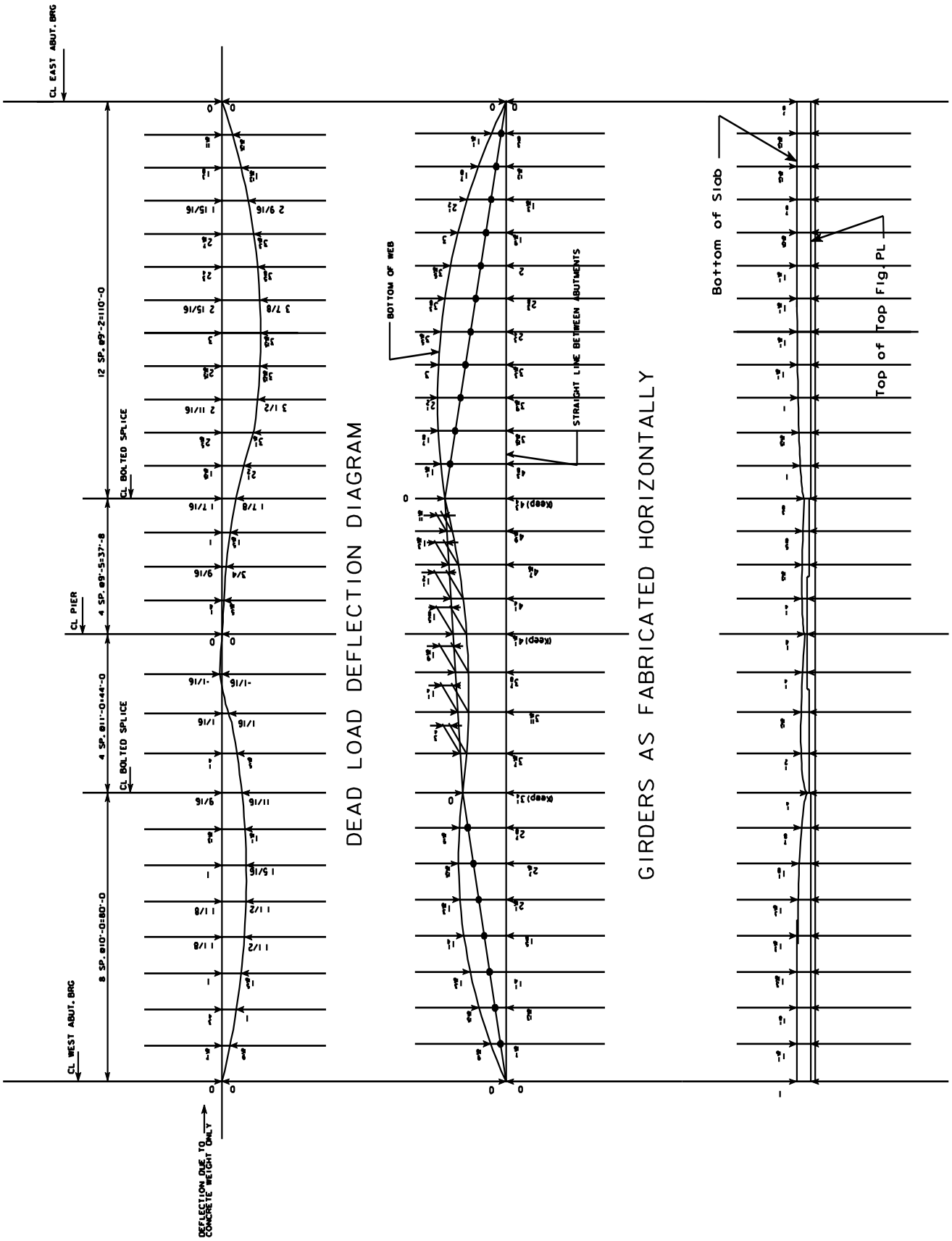
THE MAXIMUM EMBEDMENT OF THE EDGE OF THE TOP FLANGE INTO THE SLAB SHALL BE ½ INCH. SHEAR STUDS ARE TO HAVE A MINIMUM PENETRATION OF 2 INCHES INTO THE SLAB AND BE AT LEAST 2½ INCHES CLEAR OF THE TOP OF THE SLAB. THESE REQUIREMENTS WERE USED IN SETTING THE MAXIMUM AND MINIMUM ALLOWABLE FIELD HAUNCH VALUES SHOWN IN THE "MISCELLANEOUS DATA TABLE" SHOWN ELSEWHERE ON THESE PLANS.

This note no longer refers to any "nominal haunch dimension" or "haunch thickening diagram." The "Nominal Haunch Dimension" will no longer be required when using the new "Theoretical Concrete Haunch diagram". The "Haunch Thickening Diagram" will be replaced by the "Theoretical Concrete Haunch Diagram" on the design plans. The new diagram will indicate the theoretical haunch along the centerline of the girder between the bottom of slab and the top of the top flange plate. The theoretical haunch dimension at the abutment bearings is suggested to be set at one inch (25 mm) instead of 7/8 inch (22 mm) and used as a basis along with the roadway profile grade, girder camber, top flange thickness, and dead load deflection to determine the "Theoretical Concrete Haunch Diagram". Attached is an example of this diagram for a CWPG bridge.

The three diagrams described below will be developed using spacing intervals consistent with the intervals of the "Top of Slab Elevations" view. In addition to these details, the designer shall include in the design plans a "Haunch Data Detail Sheet" to aid the field personnel in the determination of the actual concrete haunch to be used for the structure. The "Haunch Data Detail

Sheet" shall give a "Table of Beam Line Haunch Elevations" and "Miscellaneous Data Table" as defined in MM No 62. The designer shall also review 5.3 (Haunches) of the Bridge Design Manual.

For a summary of the changes, see the table that follows the sample drawing sheet. If you have any questions on these changes please contact Dean Bierwagen, John Neiderhiser, or Ken Dunker.


CL EAST ABUT. BRG
CL BOLTED SPLICE
CL PIER
CL BOLTED SPLICE
CL WEST ABUT. BRG
DEFLECTION DUE TO CONCRETE WEIGHT ONLY
DEAD LOAD DEFLECTION DIAGRAM
BOTTOM OF WEB
STRAIGHT LINE BETWEEN ABUTMENTS
GIRDERS AS FABRICATED HORIZONTALLY
Bottom of Slab
Top of Top Fig. PL
THEORETICAL CONCRETE HAUNCH DIAGRAM

Haunch Policy Summary ~ 4 August 2005

Policy Item	PPCB	CWPG and RSB
Field haunch adjustment	1.0-1.5 inches for LXA-LXD, 1.5-2.0 inches for BT, BTC, BTD [BDM 5.3.1.1, 5.3.2.1]	0.5-1.0 inches [BDM 5.3.1.1, 5.3.3.1] Same as above for RSB [BDM 5.3.4.1]
Shear connectors	Min. into deck 2.5 inches [BDM 5.3.1.1, 5.3.2.1, MM No. 62] Above top flange 4.5 inches for LXA-LXD, 5 inches for BT, BTC, BTD [BDM 5.3.2.1]	Min. into deck 2 inches [BDM 5.3.3.1, MM No. 62Rev, 115] Same as above for RSB [BDM 5.3.4.1] 3½-, 4-, 5-, and 6-inch shear studs available
Design haunch	Min. at centerline 0.5 inches for LXA-LXD, 1.0 inch for BT, BTC, BTD [BDM 5.3.2.1] Min. at edge of top flange 0 inches [BDM 5.3.2.1] Max. at centerline 2.0 inches for LXA-LXD, 2.5 inches for BT, BTC, BTD [BDM 5.3.2.1]	At abutment 1.0 inch [BDM 5.3.3.1, MM No. 115, SS 4305-4310 modifications in process] At abutment 0.5 inch for RSB [BDM 5.3.4.1, SS 5252-5259] Min. at edge of top flange 0 inch [BDM 5.3.3.1, MM No. 89] Same as above for RSB [BDM 5.3.4.1] Max. at centerline 2.0 inches [BDM 5.3.3.1, MM No. 89] Same as above for RSB [BDM 5.3.4.1]
Field haunch	Max. embedment at edge of top flange 0.5 inch [BDM 5.3.2.1, MM No. 62] Min. clear above top of shear reinforcement 2.5 inches [BDM 5.3.2.1, 5.3.2.1, MM No. 62Rev, 115] Min. penetration of shear stirrups into deck 2½ inches Max. haunch at centerline 4.0 inches [BDM 5.3.2.1, MM No. 26]	Max. embedment at edge of top flange 0.5 inch [BDM 5.3.3.1, MM No. 62, 89, 115] Same as above for RSB [BDM 5.3.4.1] Min. clear above top of stud 2.5 inches [BDM 5.3.3.1, MM No. 62Rev, 89Rev, 115] Same as above for RSB [BDM 5.3.4.1] Min. penetration of shear studs into deck 2.0 inches [BDM 5.3.3.1, MM No. 89, 115] Same as above for RSB [BDM 5.3.4.1] Max. haunch at centerline 4.0 inches [BDM 5.3.3.1, MM No. 89Rev, 115] Same as above for RSB [BDM 5.3.4.1]
Detailing	"Beam Camber Data", "Slab Thickness at Beams", "Slab Thickness Details" [BDM 5.3.2.2, MM No. 62] "Haunch Data Detail Sheet" with: "Table of Beam Line Haunch Elevations", "Miscellaneous Data Table", "Haunch Locations", "Haunch Detail" [BDM 5.3.2.2, MM No. 62]	"Dead Load Deflection Diagram", "Girders as Fabricated Horizontally", "Theoretical Concrete Haunch Diagram" [BDM 5.3.3.2, MM No. 62Rev, 115] "Dead Load Deflection Diagram" [BDM 5.3.4.2, RS40 series], "Beam Camber", "Theoretical Haunch Diagram" [BDM 5.3.4.2, SS 5252-5259 modifications in process] for RSB "Haunch Data Detail Sheet" with: "Table of Beam Line Haunch Elevations", "Miscellaneous Data Table", "Haunch Locations", "Haunch Detail" [BDM 5.3.3.2, MM No. 62] "Beam Line Haunch Data" sheet with same information for RSB [BDM 5.3.4.2, SS 5261A, 5263A, etc.]

C5.3.2.2 Detailing

Methods Memo No. 62: Beam Line Haunch Elevations for PPCB and Steel Girder Bridges 28 August 2002 (Manual text changed provisions of this memo on 14 July 2005 as noted in bold type.)

In order to aid field personnel in determining haunch thickness for setting the slab formwork, the Bridge Office will provide "Beam Line Haunch" (BLH) elevations along each beam line. These BLH elevations will be in addition to and will coincide with the top of slab elevations, which we currently place on our plans at intervals of 8' (2.4 m) to 10' (3.0 m).

BLH elevations are calculated as illustrated below:

255.743	Finished top of slab elevation at CL top flange
- 0.200 m	Slab thickness
255.543	Finished bottom of slab elevation at CL top flange
+ 0.024 m	Theoretical dead load deflection due to weight of slab and diaphragm (*)
255.567	BLH Elevation at CL top flange (prior to forming slab)

* Office policy is to include deflections due to the diaphragm(s) although this is somewhat arbitrary because they are typically minor, however it is likely that diaphragms will be in place before the beam top elevations are shot.

Field personnel will shoot elevations along the top of the erected beams at the same intervals as provided on the plans. The field shots will be subtracted from the BLH elevations in order to determine the haunch. Calculations are illustrated below:

255.567	BLH elevation at CL top flange (prior to forming slab)
-255.549	Top of beam elevation shot in field (prior to forming slab, diaphragms in place)
0.018 m	Field haunch thickness at CL top flange to aid in setting forms

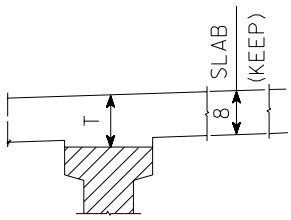
Details for incorporating BLH elevations in the plans are illustrated on the following sheets. Also included is the "Miscellaneous Data Table". The table will include the anticipated slab (and diaphragm) deflections, cross slope adjustments, and the allowable field haunch. The criteria for calculating the allowable field haunch are given below. The criteria below should not be confused with the haunch design criteria requirements as given in the Bridge Design Manual. Designers should still base their beam seat elevations on the haunch design criteria given in the Bridge Design Manual.

A. Minimum allowable field haunches at the centerline of the top flange shall be based on:
   1. The maximum allowable embedment of the shear connectors into the standard 8" (200 mm) thick slab is 5" (125mm) for PPCB and steel girder bridges. **(Substitute for this rule a minimum clearance above shear connectors of 2.5 inches (65 mm).)**
   2. A maximum embedment of ½" (15 mm) at the edge of the top flange for PPCB and steel girder bridges.

B. Maximum allowable field haunches at the centerline of the top flange shall be based on a 2.5" (60 mm) minimum allowable embedment of the shear connectors into the slab. **(Change minimum allowable embedment for CWPG and RSB bridges to 2 inches (50 mm), but continue to use 2.5 inches (65 mm) for PPCB bridges.)**

Even though the theoretical deflection for exterior beams may be different from interior beams, office policy will continue to show only deflection data for interior girder lines.

For PPCB bridges, the "Slab Thickness Detail" and corresponding note [which are usually placed near the "Beam Camber Data" and "Slab Thickness At Beams (T)"] shall be modified as shown below when BLH elevations are included in the plans.

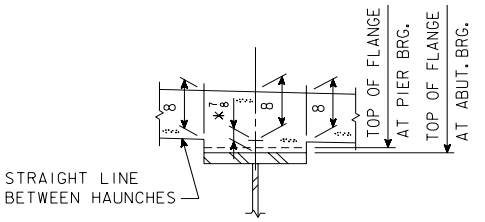


SLAB THICKNESS DETAILS

NOTE: THE SLAB THICKNESS (T) AT BEAMS IS BASED ON THE ANTICIPATED BEAM CAMBER AND DEFLECTIONS. THESE VALUES ARE USED BY THE DESIGNER TO SET BEAM ELEVATIONS AND ESTIMATE CONCRETE QUANTITIES. REFER TO HAUNCH DATA DETAIL SHEET FOR ADDITIONAL INFORMATION TO AID THE CONTRACTOR IN SETTING THE FIELD HAUNCHES REQUIRED FOR CONSTRUCTION.

When BLH elevations are included for steel girder bridges continue to show the "Dead Load Deflection Diagram" and "Haunch Thickening Diagram along Centerline of Girder" as well as the "Girder as Fabricated and Erected" diagram. **(The second and third diagrams are revised to "Theoretical Haunch Diagram" and "Girders as Fabricated Horizontally".)**

Modify the note associated with the typical slab and haunch details as shown below.



TYP. SLAB & HAUNCH DETAIL

* THE HAUNCH DIMENSION SHOWN IS THE NOMINAL HAUNCH DIMENSION NEAR THE ABUTMENT BEARINGS, AND IS USED AS A BASIS ALONG WITH THE DEAD LOAD DEFLECTION AND GIRDER PARAMETERS TO DETERMINE THE THEORETICAL HAUNCH THICKENING DIAGRAM. THIS HAUNCH THICKENING DIAGRAM IS USED BY THE DESIGNER TO SET BRIDGE SEAT ELEVATIONS AND ESTIMATE CONCRETE QUANTITIES. REFER TO THE HAUNCH DATA DETAIL SHEET FOR ADDITIONAL INFORMATION TO AID THE CONTRACTOR IN SETTING THE FIELD HANCHES REQUIRED FOR CONSTRUCTION.

(The nominal haunch dimension is revised to 1 inch. The term "haunch thickening" no longer is used.)

This information shall be provided on all plans beginning with the March 2003 letting.

Attached is an example of a Haunch Data Detail sheet for a PPCB bridge. A similar sheet will be developed when detailing a continuous welded girder bridge. Location spacings shall be modified to account for splice locations and notes shall be modified to account for variable top flange thickness and splice plates.

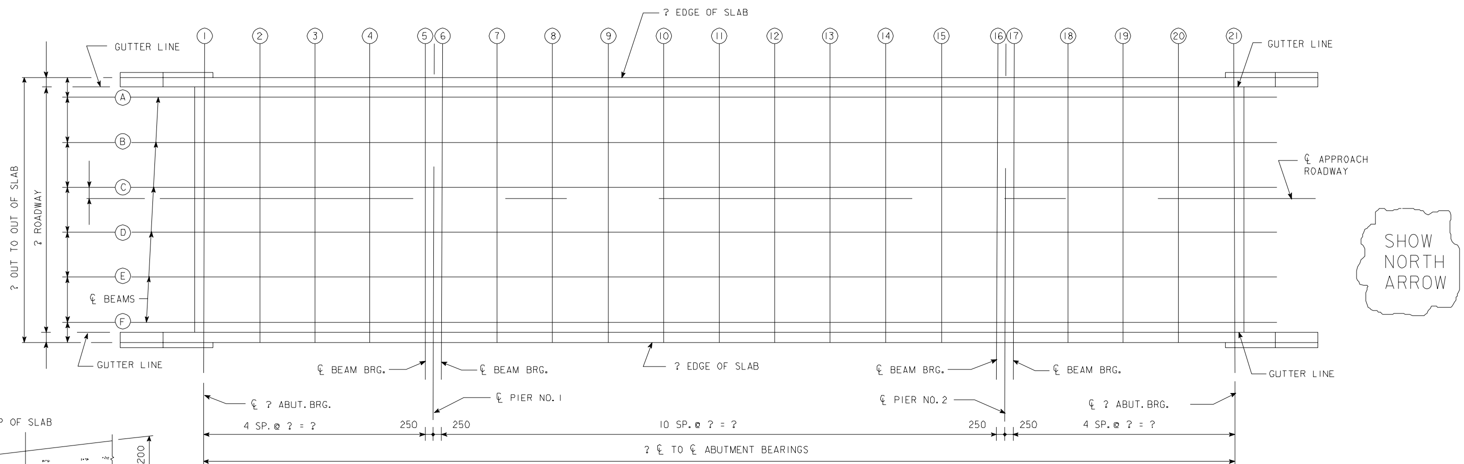
BM NO.

TABLE OF BEAM LINE HAUNCH ELEVATIONS

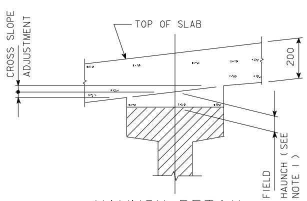
BEAM LINE	℄ ?. ABUT. BEARING				℄ PIER NO. 1 BEARINGS											℄ PIER NO. 2 BEARINGS					℄ ?. ABUT. BEARING
	LINE 1	LINE 2	LINE 3	LINE 4	LINE 5	LINE 6	LINE 7	LINE 8	LINE 9	LINE 10	LINE 11	LINE 12	LINE 13	LINE 14	LINE 15	LINE 16	LINE 17	LINE 18	LINE 19	LINE 20	LINE 21
A																					
B																					
C																					
D																					
E																					
F																					

MISCELLANEOUS DATA TABLE

	BEAM LINE		℄ ?. ABUT. BEARING				℄ PIER NO. 1 BEARINGS											℄ PIER NO. 2 BEARINGS					℄ ?. ABUT. BEARING
			LINE 1	LINE 2	LINE 3	LINE 4	LINE 5	LINE 6	LINE 7	LINE 8	LINE 9	LINE 10	LINE 11	LINE 12	LINE 13	LINE 14	LINE 15	LINE 16	LINE 17	LINE 18	LINE 19	LINE 20	LINE 21
ANTICIPATED DEFLECTION DUE TO SLAB (mm)	ALL		0				0	0										0	0				0
CROSS SLOPE ADJUSTMENTS (mm)	A, B, D, E & F																						
	C																						
ALLOWABLE FIELD HAUNCH (mm)	MAX.	ALL																					
	MIN.	ALL																					



HAUNCH LOCATIONS



HAUNCH DETAIL

NOTE 1:
TO CALCULATE FIELD HAUNCH NEEDED AT EACH LOCATION, SURVEY THE BEAM TOPS CONSISTENT WITH THE SPACINGS SHOWN ON THE "HAUNCH LOCATIONS" DIAGRAM. SUBTRACT THE SURVEYED BEAM SHOT FROM THE "BEAM LINE HAUNCH ELEVATION". THIS VALUE WILL BE THE HAUNCH NEEDED (SEE "FIELD HAUNCH" IN HAUNCH DETAIL). THE "BEAM LINE HAUNCH ELEVATION" INCLUDES ADJUSTMENTS FOR SLAB THICKNESSES AND ANTICIPATED DEFLECTIONS. NO ADDITIONAL CALCULATIONS ARE REQUIRED. IF THE FIELD HAUNCH EXCEEDS THE MAXIMUMS AND MINIMUMS INDICATED IN THE MISC. DATA TABLE, ADJUSTMENTS TO THE GRADE OR ADDITIONAL HAUNCH REINFORCEMENT WILL BE REQUIRED.

NOTE:
BRIDGE SEAT ELEVATIONS ARE SET BASED ON THEORETICAL CAMBER AND BEAM DEFLECTIONS. THESE BRIDGE SEATS WILL PROVIDE A THEORETICAL BEAM HAUNCH WITHIN DESIGN PARAMETERS. FIELD HAUNCHES ARE DETERMINED USING SURVEYED TOP OF BEAM ELEVATIONS AND "BEAM LINE HAUNCH ELEVATION" DATA. ALLOWABLE MAXIMUM AND MINIMUM "FIELD HAUNCH" VALUES ARE GIVEN IN THE "MISCELLANEOUS DATA" TABLE. "CROSS SLOPE ADJUSTMENT" VALUES WILL AID THE CONTRACTOR IN DETERMINING ACTUAL FORMED HAUNCH DIMENSIONS AT THE EDGES OF THE TOP FLANGE.

HAUNCH DATA DETAIL

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. ____ OF ____ FILE NO. ________ DESIGN NO. ________

DESIGNED BY ____________ CHECKED BY ____________
DETAILED BY ____________ CADD FILE ____________

COUNTY | PROJECT NUMBER | SHEET NUMBER

XXXXXXXXXXSYSTEMTIME XXXXXXXUSERNAME XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXDGNSPEC

C5.3.3 CWPG bridges

C5.3.3.1 Analysis and design

Methods Memo No. 89: Shear Stud Lengths and Haunch Requirements for Steel Girders
26 January 2004

See C5.5.1.4.1.8.

Methods Memo No. 115: Revised Haunch Policies
19 May 2005

See C5.3.2.1

C5.3.3.2 Detailing

Methods Memo No. 115: Revised Haunch Policies
19 May 2005

See C5.3.2.1.

Methods Memo No. 62: Beam Line Haunch Elevations for PPCB and Steel Girder Bridges
28 August 2002

See C5.3.2.2.

C5.3.4 RSB bridges

C5.3.4.1 Analysis and design

Methods Memo No. 115: Revised Haunch Policies
19 May 2005

See C5.3.2.1.

C5.3.4.2 Detailing